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CONTENTS

EXTERIOR WATERPROOFING MATERIALS FOR MASONRY

The clear waterproofing materials designed for application to the exterior faces of masonry buildings are used to a considerable extent to prevent the penetration of dampness through walls. In case of heavy rainstorms, moisture may penetrate through the pores of masonry units, through the pores of the mortar joining the units, or through openings which often occur between the units and the mortar. The exterior waterproofings are intended to seal the pores of the masonry at the exposed face without materially changing the natural appearance. Cracks visible to the naked eye, usually cannot be sealed with a waterproofing treatment of this nature.

In order to supply the demand for information on the reliability of these treatments an investigation was started at the Bureau in 1921, to determine chiefly: (1) The effectiveness of the different types of treatment in sealing the pores of masonry, and (2) the durability of the treatments. The initial effectiveness can be readily determined by treating specimens of the masonry units and measuring the reduction of absorption. The durability can be determined only by exposure tests which require a number of years.

Samples of the various trade products were collected, classified, and applied to masonry materials. Such processes of a nonproprietary nature as have been used or suggested were also included in the studies.

The results of this investigation are given in RP771 in the March number of the Journal of Research. It was found that some types of treatment were of little value from the start, and others which initially gave good waterproofing values, deteriorated rapidly. However, some types have quite consistently shown high waterproofing values over exposure periods of 8 to 12 years.

Wax types were found to be the most durable but they have the unde-

sirable property of producing discolorations on most masonry materials. The insoluble soap type produces no appreciable discoloration but it is not very durable. Fairly satisfactory results were obtained with thinned fatty oils, and better lasting qualities were indicated for these oils with a high-melting paraffin in solution; however, with such types it seems necessary to adapt the consistency of the treatment to the pore structure of the particular masonry under consideration. Treatments such as normal varnishes of thin consistency, lacquers, and wax emulsions which produce a film; treatments consisting of two reacting solutions which produce insoluble precipitates; and treatments which are intended to react with the masonry were not found to be very effective.

Some information was obtained, incidentally, on the preservative value of waterproofing treatments and the adaptability of the treatments to pore structure. The more effective and durable types retarded the solvent action of rain water on calcareous materials, and increased the resistance of masonry material to frost action; they also appeared to have some value in overcoming the crystallizing action of salts, which is a common cause of masonry decay.

It was found that waterproofing treatments usually are not equally effective on different types of pore structure. In general, the more porous materials are easiest to waterproof and materials having very fine pores are difficult to seal.

SPECIFICATIONS FOR FOUNDRY SANDS

In cooperation with the United States Naval Gun Factory, a study is under way at the Bureau of the various foundry sands which are used in molding practice in the former institution. To date, the physical properties of 14 types of foundry sands have been studied, and the limits for variation in grain fineness number, grain content class, grain distribution, grain shape, permeability, compressive and tensile strengths, surface hardness, and sintering point have been established. On the basis of these data, purchase specifications have been formulated. Each type of foundry sand requested by bid is required to be equivalent to a reference sample maintained at the National Bureau of Standards upon which physical properties have been determined. Each specification indicates methods for sampling sands and suitable methods of testing are also briefly described. With the uniformity of supplies of sands obtained by these specifications, a standardization of molding practice and general improvement in the castings obtained should be expected.

HARDENING CHARACTERISTICS OF CARBON TOOL STEEL

Work in progress at the Bureau on the hardening characteristics of 1-percent carbon tool steels has clearly demonstrated that the critical quenching rate of a steel of this type may depend not only upon the grain-size characteristics of austenite, the high-temperature constituent of steel, but also upon the initial structure, existing in the steel before it is heated for quenching and hardening. For example, identical samples of a specific steel which was not a so-called "controlled grain size" steel, were heat treated to produce microstructures which were widely different, coarsely grained lamellar pearlite in one case, and completely sorbitic structure in the second. The pearlitic specimen when quenched in brine from 773° C (1,425° F) was more brittle, hardened to a greater depth, and had a coarser grained fracture than the companion sorbitic specimen after being quenched from 815° C (1,500° F).

It appears possible, therefore, to change a steel from a "deep hardening" to a "shallow hardening" steel, or vice versa, not only by suitably changing the temperature attained just prior to quenching, but also by changing the initial microstructure of the steel. The effect of the initial structure may completely offset the effect of an increase in quenching temperature which might otherwise bring about deeper hardening in the steel.

EXPOSURE TESTS OF SCREEN WIRE-CLOTH

In 1925, atmospheric exposure tests were started on insect-screen wire-cloth of copper and copper alloys available commercially at that time. The Bureau was requested by the American Society for Testing Materials, sponsor of the investigation, to act as custodian and inspector of the exposed screens and to make such supplementary tests of the materials as might be necessary to interpret the effects of exposure. The Bureau arranged to have the screens exposed on roofs of Government buildings at Cristobal, Canal Zone, Portsmouth, Va., Pittsburgh, Pa., and Washington, D. C. The prevailing atmospheric conditions

at these locations may be considered typical of tropical marine, temperate marine, heavy industrial, and mild exposure, respectively.

Similar screens prepared under the supervision of the committee, from each of seven materials, have been exposed continuously to the weather at each of the four locations since 1925. Recently the exposure tests were terminated at all locations except at Washington.

Pending the completion of detailed examinations of the screens and screen materials now in progress and the preparation of the final report, it may be said that copper screen wirecloth has "held its own" in all locations. Some of the competing materials were found to be very variable in their behavior according to the location.

PREPARATION, USE AND ABUSE OF SPECIFICATIONS FOR PAINT MATERIALS

In a paper read before the paint symposium of the American Society for Testing Materials, P. H. Walker, chief of the Bureau's paint section, presented his views of what a specification should be, and discussed the use of specifications by purchasing agents, including the conditions under which it is unwise to use specifications at all. Mr. Walker also gave a brief account of the development of ASTM specifications and of Government specifications before and after the formation of the Federal Specifications Board, a discussion of the relationship between the Federal Specifications Board's technical committee on paint and Committee D–1 of the ASTM, and a discussion of certain popular misunderstandings as to the functions of the Federal Specifications Board. The kinds of paints and of paint-making materials for which specifications have been prepared by the Federal Specifications Board only, by the ASTM only, and by both organizations, were listed in four tables. It appears that in general the ASTM specifies materials used by manufacturers while the Federal Specifications Board covers materials used by the ultimate consumer.

SPECIFICATIONS FOR THE PROTECTION OF UNDERGROUND PIPES

Within recent years the Bureau has undertaken more than 10,000 field tests of 170 varieties of pipe coatings, and approximately 600 examinations of coatings applied to working lines have been made. These tests, together with those made in the laboratory, have greatly extended the information available on the relative merits of coatings and causes of failure. Nevertheless, data upon which to base a reasonable estimate of whether or not it will pay to apply a coating to a given pipe line are very meager. The use of protective coatings would be advanced by data on the extent to which they reduce the number of leaks, and by the development of specifications which would enable purchasers to call for coatings having definite properties, and under which the delivered material could be tested. Such specifications have not been prepared, but information is available or obtainable on which adequate specifications could be based. The user of pipe coatings should either develop specifications to cover his requirements or purchase guaranteed protection rather than mere coating materials.

EBULLIOSCOPIC METHOD FOR DETERMINING THE MOLECULAR WEIGHTS OF NONVOLATILE PETROLEUM FRACTIONS

Accurate molecular weights are an essential aid to the chemical investigation of the lubricating oil fraction of petroleum. As described in the Journal of Research for March (RP772), a modified Cottrell boiling-point apparatus has been used at the Bureau in conjunction with a differential thermoelement to obtain precise values for the boiling-point elevation. The behavior of *n*-nonacosane, anthracene, triphenylmethane, and two oil samples in "isooctane", *n*-heptane, and benzene, and of biphenyl in benzene has been studied. The ebullioscopic constants or apparent molecular weights have been shown to be a linear function of the concentration. Accurate molecular weights are not possible if the customary methods of calculation are employed, no matter what the precision with which the boiling-point elevation is determined. Accurate molecular weights may be obtained if the value of the ebullioscopic constant at infinite dilution is first determined by extrapolation from measurements made over a sufficient range of concentrations. Using this infinite dilution value, the apparent molecular weight of the unknown is computed from observations over a range of concentrations and the molecular weight obtained by extrapolation to infinite dilution. Employing this method, the average value for the molecular weight of triphenylmethane in "isooctane", *n*-heptane, and

benzene was 243.4, compared with the theoretical value 244.14, and for biphenyl in benzene 153.7 as compared with 154.08.

OPTICAL ROTATIONS AND OTHER PROPERTIES OF THE LEAD AND CALCIUM ALDONATES

The preparation and properties of numerous lead and calcium salts of the aldonic acids are reported in RP770 in the March number of the Journal of Research. It is shown that the addition of lead salts to the alkaline earth salts of the α-hydroxy acids causes large changes in specific rotation, which follow with striking regularity the configuration of the α-carbon atom in the aldonic acid. Evidence is presented to show that the lead aldonates are acids which can be titrated with standard alkali and that their solutions give rise by hydrolysis to small quantities of the free aldonic acids which undergo lactone formation, causing small changes in rotation.

ELECTROLYTIC OXIDATION OF XYLOSE IN THE PRESENCE OF ALKALINE EARTH BROMIDES AND CARBONATES

It has been found that calcium, strontium, and magnesium xylonates can be prepared by electrolytic oxidation in a manner analogous to that used for preparing calcium gluconate and can be separated as crystalline salts in good yield from the electrolyzed solutions. Crystalline calcium and magnesium xylonates are new substances which may prove useful intermediates for the preparation of other substances such as threose or trihydroxyglutaric acid.

The method is fully described in RP773 in the March number of the Journal of Research.

STANDARD TABLES FOR CHROMEL-ALUMEL THERMOCOUPLES

The most commonly used device for measuring high temperatures is the thermocouple, which consists of two wires of dissimilar metals, joined together at one end (measuring junction). In use the other ends of the wires (reference junctions) are connected to some sensitive electrical indicator. When the measuring junction is at a temperature different from that of the reference junctions an electromotive force is developed which indicates the temperature of the measuring junction when the temperature of the reference junctions is known.

Thermocouples are usually divided into two classes, those made of noble metals (usually metals or alloys of the platinum group), and those made of base metals. Standards have been set up and accepted for noble-metal couples, but very little standardization has been done in the case of base-metal couples which comprise the large majority of all the thermocouples actually used.

As described in the Journal of Research for March (RP767), the pyrometry section of the Bureau has just set up standards for an important type of base-metal couple, namely, chromel versus alumel. A study was made of the characteristics of the chromel-alumel couples now being manufactured, and standard reference tables have been prepared showing the electromotive force for any temperature of the measuring junction, from −184 to 1,371° C (−300 to 2,500° F) when the reference junction is in melting ice, 0° C (32° F). The tables provide the manufacturer of thermocouples with a standard to which his future product can be made to conform, and the user with a criterion for determining whether this product is acceptable. It is also possible by plotting the small deviations of any particular couple from the standard table at a few points to arrive at the deviations at all other points and thus secure a calibration that is more accurate than could have previously been obtained by this method.

TESTING THERMOCOUPLES AND THERMOCOUPLE MATERIALS

The application of temperature measurement and control to the innumerable heat-treating processes used in the arts and industries, particularly those requiring high temperatures, had hardly started at the beginning of the present century. At present, temperature measurement and control are recognized as indispensable in many processes, and the production of the materials and instruments needed for the purpose has developed into a considerable industry in itself. As described in the preceding item, the thermocouple is one of the simplest, most useful, and most widely employed devices for temperature measurement.

The calibration of a thermocouple consists in determining a table of corresponding values of temperature and voltage. The various methods of calibrating thermocouples and of testing thermocouple materials at the Bureau are described in RP768 in the March number of the Journal of Research. The accuracy attainable by the vari-

ous methods and the precautions necessary in realizing this accuracy are also discussed.

A PRECISION CATHETOMETER

In a measurement of length by comparison, where 2 reading microscopes can be set on the object being measured and then on a standard scale, the principal requirements for accuracy is that the distance between the 2 microscopes remains invariable while making a set of observations.

With the cathetometer described in RP774 in the March Journal of Research, this requirement is fulfilled as well as in the most expensive instruments. Yet, with the exception of the microscopes, the instrument may be built in an ordinary shop.

The two microscopes are carried on a vertical shaft which is supported by a commercial ball bearing of the self-aligning type at the base and a V-block type of bearing at the top. These bearings allow the shaft to be rotated very smoothly, without any stresses which would tend to vary the distance between the two microscopes.

The instrument has been used for a great many measurements on the length of single-layer inductance coils and found to be very satisfactory for this work. It should be pointed out, however, that in a measurement of this kind, where the microscope must be read alternately on two objects very different in character, the errors resulting from inaccurate focussing, which are always present, were especially troublesome.

FIRE EXTINGUISHING EQUIPMENT FOR SHIPS

Twenty years or more ago the Steamboat Inspection Service (now a part of the United States Bureau of Navigation and Steamboat Inspection) had an approved list of fire-extinguishing appliances which were permitted to be used on ships subject to that Service's inspection. It was found that in several instances extinguishers on this list either were not suitable for the type of fire risk for which they were used, or were not constructed so as to give satisfactory performance. As a result of this situation the Steamboat Inspection Service purchased several samples each of practically every extinguisher which had ever been approved and submitted the entire lot to the Bureau for investigation during 1916 and 1917.

This investigation was made and a report rendered in 1917. The extinguishers were classified into different groups and it was found that certain whole groups were unsuitable. Other extinguishers, suitable as to type, were found to be improperly constructed or did not give the performance which appeared to be suitable. Extinguishers which were found to be unsuitable were then removed from the list of approved extinguishers, and a regulation was adopted by the Steamboat Inspection Service that before any new type of extinguisher could be approved it must first be tested at the National Bureau of Standards.

The investigation was subsequently extended to cover all types of chemical extinguishing equipment used on ships, including complete extinguishing systems. Samples of these devices are submitted for test and examination, and for the formulation of new requirements as new types are presented.

Three distinct lines of defense against fire on ships are set up by the Bureau of Navigation and Steamboat Inspection in its regulations. First, there are the hand portable extinguishers which are widely distributed all over the ship so as to be at hand for instant use on incipient fires. Then there are the stationary units of large capacity, for example, multiple cylinders of carbon dioxide, and foam extinguishers of the large stationary type. These devices are intended for use for extra-hazardous risks, such as fires in fire rooms of oil-burning vesels. Lastly, there are the complete systems for flooding whole compartments when the fire has passed the incipient stage. An example is the carbon-dioxide flooding system.

When the National Bureau of Standards receives a fire-extinguishing device, it is examined first for performance and reliability in operation with particular reference to its use on ships. Observations are made of the character of the discharge, the duration, and (principally for the portable extinguisher only) the range of the discharge. Tests are then made to determine if, after having been charged for a prolonged period, the device can be depended upon to function in the same manner as when freshly charged.

The extinguisher is also discharged on an actual fire, the type of test-fires chosen being easily reproducible so as to furnish a measure or "standard" by which the performance of different extinguishers can be gaged. The de-

vice is also examined as to the character and quality of its construction with reference not only to reliability but also to safety in operation.

During the fiscal year ended June 30, 1934, approximately 100 items of fire extinguishing equipment, ranging from hand extinguishers to complete systems, were put through these thorough tests by the Bureau for Government agencies. The majority of them were for the Bureau of Navigation and Steamboat Inspection. Thus, these two Bureaus of the Department of Commerce have cooperated for many years to lessen the risk of that most dreaded of all disasters—fire at sea.

MULTIFREQUENCY IONOSPHERE RECORDING AND ITS SIGNIFICANCE

The importance of the region of the upper atmosphere, called the "ionosphere", in radio transmission has led to extensive studies of its properties during the last few years. In its passage from the transmitting to the receiving station the radio wave may travel by way of the ionosphere as well as along the ground. In fact, the long-distance transmission of short waves is entirely dependent on the ionosphere. It is well known that the waves which depend on the ionosphere are subject to rapid changes in strength and that they may "fade" out completely at times. It is the purpose of experiments at the Bureau (reported in RP769 of the March Journal of Research) to assist in the explanation of some of the transmission problems which have arisen.

In the most common type of experiment, short pulses of radio-frequency energy are sent out and the time required for them to reach the ionosphere and return is recorded. This time interval gives an approximate measure of the height reached. The time required for a pulse to reach a height of 100 miles and return to earth is slightly over 0.001 second. It has been found that there are at least three layers in the ionosphere which return energy during the daytime. The lowest layer, which is at a height of about 70 miles, has been called the E layer. Above this, at heights of the order of 110 to 150 miles, is the F_1 layer, while still higher at 170 miles and more, is the F_2 layer. At night the F_1 and F_2 layers merge into a single F layer at a height of 150 miles or greater. In addition to the more or less regular layers others are sometimes observed. Scattered reflections have been observed coming from heights of more than 1,000 miles. Ultraviolet light from the sun is largely responsible for the "ionized" condition of the upper atmosphere. When ultraviolet light strikes the atoms or molecules of the oxygen and nitrogen of the atmosphere, electrons are released. In the F region these electrons are responsible for the bending of the radio waves back to earth, while in the E region it is likely that "heavy ions" are responsible. Heavy ions are atoms or molecules which have extra electrons or which have lost electrons.

As a result of the Bureau's experiments, it is hoped to determine the density of ionization and how it changes with time of day and season. In order to determine the density of ionization of a layer it is necessary to determine its "critical frequency", which is the lowest radio frequency which will penetrate it. In obtaining the results described in the present report the pulse transmitter and receiving set are gradually changed from a low to a high frequency. When the critical frequency for the lowest layer is reached the waves penetrate it and return from the next higher layer. The present automatic equipment is arranged to cover a frequency band from 2,500 to 4,400 kilocycles in 9.5 minutes. A photographic record is made each hour showing the critical frequencies in this band. The critical frequencies are obtained for the E and F_1 layers in the daytime and for the F layer at night. The results cover a 1-year period between May 1933 and April 1934, and are presented in the form of hourly average curves for each layer for each month. The critical frequencies of the E and F_1 layers follow in phase with the sun, both with time of day and season. The results obtained for the F layer during the winter night are of particular interest. After dropping to a minimum near midnight the critical frequency increases to a maximum at about 4:00 a. m., then drops to a second minimum before sunrise. This increase during the night represents an increase of more than 100 percent of maximum electron density. No explanation has yet been found to account for this phenomenon. The results for part of September 1933, are compared with those for the same period of 1934 showing a considerably greater ionization density for the latter period. Whether or not this increase is connected with the upturn of the new sunspot cycle is not yet certain.

Some of the results have been studied in connection with a practical

communication problem which was concerned with skipping of signals in short-distance transmission along one of the airways. The results are used to determine the limiting frequency for any distance up to a few hundred miles.

Information of the type presented should prove useful in the study of the properties of the upper atmosphere, as well as in the interpretation of communications problems.

It is desirable that these experiments be continued over a longer period of time and for a wider band of frequencies. Information obtained in this manner for different parts of the world should prove useful in the intelligent allocation of frequencies to be used for different types of service.

MONITORING THE STANDARD RADIO FREQUENCY EMISSIONS

The Bureau's standard radio-frequency emissions are continuously recorded in terms of its primary standard of frequency. Special equipment, designed and constructed for this purpose, is mounted on two relay racks and operates from the 110-volt alternating-current power line. The transmitted signal is received at the main laboratory and heterodyned with the output of an auxiliary piezo oscillator, the frequency of which is adjusted to produce a beat frequency of approximately 1,200 cycles per second. The harmonic of the primary standard, which corresponds to the frequency transmitted, is likewise heterodyned with the auxiliary piezo oscillator, and another beat frequency is produced. The difference between the two audio beat frequencies is the frequency difference between the transmitted signal and the corresponding harmonic of the primary standard. A reference standard is chosen which produces a frequency difference between 1 and 5 cycles per second, which is then recorded by means of a recording potentiometer and a circuit arrangement which produces a potential difference that is proportional to the frequency difference.

Records of the emissions between January and October 1934, inclusive, show that they were in agreement with the primary frequency standard within 2 parts in 100,000,000 at practically all times. The absolute value of the frequency transmitted deviated from the nominal value by 2 parts in 10,000,000 on a few occasions, although during the majority of the transmissions the departure was less than 1 part in 10,000,000. The errors in the absolute value of the frequency are caused by the difference between the value of the frequency of the primary standard assigned at the time of the emissions and the final value, which is obtained after all corrections are made. Measurements at the British National Physical Laboratory and at the monitoring station maintained by the Federal Communications Commission at Grand Island, Nebr., show an agreement with those at the National Bureau of Standards within 1 part in 10,000,000.

A more complete account of these monitoring arrangements will be found in RP766 in the March number of the Journal of Research.

JOINT MEETING OF THE INSTITUTE OF RADIO ENGINEERS AND AMERICAN SECTION, INTERNATIONAL SCIENTIFIC RADIO UNION

A joint meeting of the Institute of Radio Engineers and the American Section of the International Scientific Radio Union will be held in Washington on April 26. There will be two sessions at the National Academy of Sciences Building, 2101 Constitution Avenue, beginning at 10 a. m. and 2 p. m. Papers will be limited to 15 minutes each to allow time for discussion. The following papers are listed at the time of going to press:

The London general assembly of the International Scientific Radio Union. By J. H. Dellinger, National Bureau of Standards.

Further results of a study of ultra-short-wave transmission phenomena. By C. R. Englund, A. B. Crawford, and W. W. Mumford, Bell Telephone Laboratories.

Experiments with ultra-high-frequency transmitting antenna in close proximity to the ground. By H. Diamond and F. W. Dunmore, National Bureau of Standards.

Ionosphere measurements during the partial eclipse of the sun of February 3, 1935. By J. P. Schafer and W. M. Goodall, Bell Telephone Laboratories.

The graphical analysis of a 10,000-hour Kennelly-Heaviside layer record. By Harry Rowe Mimno, Harvard University.

Recent ionosphere measurements in the Southern Hemisphere. By L. V. Berkner, H. W. Wells, and S. L. Seaton, Carnegie Institution of Washington.

Some continued observations of ultra-high-frequency signals over long indirect paths. By Ross A. Hull, American Radio Relay League.

Terrestrial magnetism and its relation to world-wide short-wave communications. By Henry E. Hallborg, RCA Communications, Inc.

Radio propagation over spherical earth. By C. R. Burrows, Bell Telephone Laboratories.

Direction-finding of atmospherics, By John T. Henderson, National Research Council of Canada.

Theoretical explanation of published measurements of vertical plane radiation characteristics of high vertical radiators. By K. A. MacKinnon, Canadian Radio Broadcasting Commission.

Some developments in low loss inductances. By F. E. Terman, Stanford University.

Measurement of high-frequency impedance with networks simulating lines. By W. L. Barrow, Massachusetts Institute of Technology.

The accuracy of the low-voltage cathode-ray tube for oscillographic radio measurements. By L. E. Swedlund, Westinghouse Electric and Manufacturing Co.

The detection of frequency modulated waves. By J. G. Chaffee, Bell Telephone Laboratories.

A novel modulation meter. By H. N. Kozanowski, Westinghouse Electric and Manufacturing Co.

On the nature of transmitter key clicks and their suppression. By A. Hoyt Taylor and L. C. Young, U. S. Naval Research Laboratory.

Grid dissipation as a limiting factor in vacuum tube operation. By I. E. Mouromtseff and H. N. Kozanowski, Westinghouse Electric & Manufacturing Co.

Application of secondary emission. By K. V. Zworykin, RCA-Victor Co., Inc.

Supplementary Program

[Papers to be presented if time permits]

A graphical aid in the design of networks for distortion correction. By E. A. Guillemin, Massachusetts Institute of Technology.

The directive antenna of KYW station. By R. N. Harmon, Westinghouse Electric & Manufacturing Co.

Industrial high frequency generators using vacuum tubes. By H. V. Noble, Westinghouse Electric & Manufacturing Co.

NEW AND REVISED PUBLICATIONS ISSUED DURING FEBRUARY 1935

Journal of Research[1]

Journal of Research of the National Bureau of Standards, vol. 14, no. 2, February 1935 (RP nos. 759 to 765, inclusive). Price 25 cents. Obtainable by subscription.

Research Papers[1]

[Reprints from the December 1934 Journal of Research]

RP744. Ultraviolet transmission changes in glass as a function of the wave length of the radiation stimulus. W. W. Coblentz and R. Stair. Price 5 cents.

RP745. Isolation of a nonanaphthene from an Oklahoma petroleum. J. D. White and F. W. Rose, Jr. Price 5 cents.

RP746. Investigation of commercial masonry cements. J. S. Rogers and Raymond L. Blaine. Price 5 cents.

RP747. Young's modulus of elasticity at several temperatures for some refractories of varying silica content. R. A. Heindl and W. L. Pendergast. Price 5 cents.

RP748. Comparison of the ground-plane and image methods for representing ground effect in tests on vehicle models. R. H. Heald. Price 5 cents.

RP749. Air forces and yawing moments for three automobile models. R. H. Heald. Price 5 cents.

RP750. Permeability of synthetic film-forming materials to hydrogen. T. P. Sager. Price 5 cents.

Miscellaneous Publications[1]

M146. Psychrometric charts for high and low pressures. D. B. Brooks. Price 5 cents.

Annual Report of the Director of the National Bureau of Standards for the fiscal year ended June 30, 1934 (reprinted from the Annual Report

[1] Send orders for publications under this heading only to the Superintendent of Documents, Government Printing Office, Washington, D. C., unless otherwise noted. Subscription to Technical News Bulletin, 50 cents per year; Journal of Research, $2.50 per year (United States and its possessions, Canada, Cuba, Mexico, Newfoundland, the Philippines, and the Republic of Panama); other countries, 70 cents and $3.25, respectively.

of the Secretary of Commerce, 1934). Free on application to the Bureau.

Technical News Bulletin [1]

Technical News Bulletin no. 214, February 1935. Price 5 cents. (Obtainable by subscription.)

LETTER CIRCULARS

It is the intent of the Bureau to distribute single copies of these Letter Circulars on request only to those parties having special interest in the individual Letter Circular. Economy necessitates limitation in the number of copies issued. It is not the intent to supply parties with a copy of each Letter Circular issued during the month. Letter Circulars are necessarily of a temporary nature designed to answer numerous inquiries on a given subject. Requests should be addressed to the National Bureau of Standards.

LC436. Treatments for silk stockings.

OUTSIDE PUBLICATIONS [2]

Nomenclature of the alpha and beta sugars. H. S. Isbell. J. Chemical Education (Easton, Pa.), **12**, 96 (February 1935).

Influence of magnesium sulphate on the deterioration of vegetable-tanned leather by sulphuric acid. R. C. Bowker, E. L. Wallace, and J. R. Kanagy. J. Am. Leather Chemists Assn. (Ridgway, Pa.), **30**, 91 (February 1935).

Effect of melting conditions on the running quality of aluminum. A. I. Krynitsky and C. M. Saeger, Jr. The Metal Industry (22 Henrietta St., London, W. C. 2, England), **46**, 119 (Jan. 25, 1935).

Trends in the production and use of various types of hydraulic cements. P. H. Bates. J. Am. Concrete Institute (7400 Second Boulevard, Detroit, Mich.), **6**, 225 (January-February 1935).

Tests of Mesnager hinges. D. E. Parsons and A. H. Stang. J. Am. Concrete Institute (7400 Second Boulevard, Detroit, Mich.), **6**, 304 (January–February 1935).

Effect of calcium chloride on portland cements and concretes. Paul Rapp. Preprint from Proc. 14th Annual Meeting of the Highway Research Board (Division of Engineering and Industrial Research, National Research Council, Washington, D. C.), December 1934.

[1] Send orders for publications under this heading only to the Superintendent of Documents, Government Printing Office, Washington, D. C., unless otherwise noted. Subscription to Technical News Bulletin, 50 cents per year; Journal of Research, $2.50 per year (United States and its possessions, Canada, Cuba, Mexico, Newfoundland, the Philippines, and the Republic of Panama); other countries, 70 cents and $3.25, respectively.

[2] These publications are not obtainable from the Government. Requests should be sent direct to the publishers.

U. S. GOVERNMENT PRINTING OFFICE: 1935